

We claim:

1. A process for the joint preparation of

5 (i) formic acid (III);

(ii) a carboxylic acid having at least two carbon atoms (II) and/or derivatives thereof; and

10 (iii) a carboxylic anhydride (VII),

which comprises

15 (a) transesterifying a formic ester (I) with a carboxylic acid having at least two carbon atoms (II) to form formic acid (III) and the corresponding carboxylic ester (IV);

(b) carbonylating at least part of the carboxylic ester (IV) formed in step (a) to form the corresponding carboxylic anhydride (V); and

20 (c) transanhydriding at least part of the carboxylic anhydride (V) formed in step (b) with a carboxylic acid (VI) to form a carboxylic anhydride (VII) and the carboxylic acid (II).

2. A process as claimed in claim 1, wherein

25 (d) at least part of the carboxylic acid (II) formed in step (c) is recirculated to step (a).

3. A process as claimed in claim 1 or 2, wherein the transanhydridation in step (c) is carried out in the presence of an acidic or basic ion exchanger or an acidic or basic oxide.

30 4. A process as claimed in claim 1 or 2, wherein the transanhydridation in step (c) is carried out in the presence of an organic or inorganic acid which has a pK_a which is lower than that of the carboxylic acid (VI) and the carboxylic acid (II).

35 5. A process as claimed in claim 1 or 2, wherein the transanhydridation in step (c) is carried out in the presence of a metal ion from groups 1 to 13 of the Periodic Table.

6. A process as claimed in any of claims 1 to 5, wherein the transanhydridation in step (c) is carried out in a continuously operated distillation column and the reaction products

40 carboxylic acid (II) and carboxylic anhydride (VII) formed are continuously taken off.

7. A process as claimed in any of claims 1 to 6, wherein the formic ester (I) used is methyl formate.
- 5 8. A process as claimed in any of claims 1 to 7, wherein the carboxylic acid (II) used is acetic acid.
9. A process as claimed in any of claims 1 to 8, wherein the carboxylic anhydride (VII) prepared is propionic anhydride, butyric anhydride, acrylic anhydride, methacrylic anhydride and/or benzene-1,2,4,5-tetracarboxylic dianhydride.
- 10 10. A process as claimed in any of claims 1 to 9, wherein
 - (i) formic acid (III) is prepared;
 - 15 (ii) the carboxylic acid having at least two carbon atoms (II) and/or derivatives thereof prepared is/are acetic acid, methyl acetate and/or acetic anhydride; and
 - (iii) the carboxylic anhydride (VII) prepared is propionic anhydride, butyric anhydride, acrylic anhydride, methacrylic anhydride and/or benzene-1,2,4,5-tetracarboxylic dianhydride.

Flexible process for the joint preparation of (i) formic acid, (ii) a carboxylic acid having at least two carbon atoms and/or derivatives thereof and (iii) a carboxylic anhydride

Abstract

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Process for the joint preparation of

(i) formic acid (III);

10 (ii) a carboxylic acid having at least two carbon atoms (II) and/or derivatives thereof; and

(iii) a carboxylic anhydride (VII),

which comprises

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(a) transesterifying a formic ester (I) with a carboxylic acid having at least two carbon atoms (II) to form formic acid (III) and the corresponding carboxylic ester (IV);

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(b) carbonylating at least part of the carboxylic ester (IV) formed in step (a) to form the corresponding carboxylic anhydride (V); and

(c) transanhydriding at least part of the carboxylic anhydride (V) formed in step (b) with a carboxylic acid (VI) to form a carboxylic anhydride (VII) and the carboxylic acid (II).